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A Virtualized Computing Platform For Fusion Control Systems

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The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is a stadium-sized facility that contains a 192-beam, 1.8-Megajoule, 500-Terawatt, ultraviolet laser system together with a 10-meter diameter target chamber with room for multiple experimental diagnostics. NIF is the world's largest and most energetic laser experimental system, providing a scientific center to study inertial confinement fusion (ICF) and matter at extreme energy densities and pressures. NIF's laser beams are designed to compress fusion targets to conditions required for thermonuclear burn, liberating more energy than required to initiate the fusion reactions. 2,500 servers, 400 network devices and 700 terabytes of networked attached storage provide the foundation for NIF's Integrated Computer Control System (ICCS) and Experimental Data Archive. This talk discusses the rationale & benefits for server virtualization in the context of an operational experimental facility, the requirements discovery process used by the NIF teams to establish evaluation criteria for virtualization alternatives, the processes and procedures defined to enable virtualization of servers in a timeframe that did not delay the execution of experimental campaigns and the lessons the NIF teams learned along the way. The virtualization architecture ultimately selected for ICCS is based on the Open Source Xen computing platform and 802.1Q open networking standards. The specific server and network configurations needed to ensure performance and high availability of the control system infrastructure will be discussed.

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